

Two new species of Poduromorpha (Collembola) from the Mercantour National Park (Alpes-Maritimes, France), with comments on pseudopore patterns

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ABSTRACT

Sampling carried out in the framework of the All Taxa Biodiversity Inventory project in the Mercantour-Alpi Maritime national parks (southwestern Alps) provided a number of Collembola species new to the region, including several taxa new to science. Two species are described in this paper: *Orogastrura tetrophthalma* n. sp. (Hypogastruridae) and *Deutonura jeromoltoi* n. sp. (Neanuridae). *O. tetrophthalma* n. sp. is the first species of the genus found in the southwestern Alps. It differs from all other species of *Orogastrura* Deharveng & Gers, 1979 by the large size of its postantennal organ (more than twice as long as eye diameter) and the presence of 4+4 eyes. *Deutonura jeromoltoi* n. sp. is the third species of the genus recorded from the southwestern Alps, and the first *Deutonura* Cassagnau, 1979 endemic to this region. It is closely related to *D. igilica* Dallai, 1983 from Sardinia, from which it differs by having height-nine dorso-lateral chaetae on Abd. IV (vs seven in *D. igilica*), and a different arrangement of chaetae on the central cephalic area (B-B:A-B = 1.1, vs 0.9 in *D. igilica*). The complete pattern of pseudopores is described for *Deutonura jeromoltoi* n. sp. and its potential interest as a diagnostic character at supra-generic levels within the order Poduromorpha is discussed.

KEY WORDS
Hypogastruridae,
Neanuridae,
new species.

RÉSUMÉ

Deux espèces nouvelles de Poduromorpha (Collembola) du Parc national du Mercantour (France, Alpes-Maritimes), avec des remarques sur les patrons de pseudopores.

L'échantillonnage entrepris dans le cadre du projet d'inventaire biologique généralisé des parcs nationaux Mercantour-Alpi Marittime (sud-ouest des Alpes) a fourni un grand nombre d'espèces de collemboles nouveaux pour la région, ainsi que plusieurs espèces nouvelles pour la science. Deux espèces sont décrites dans cet article : *Orogastrura tetrophthalma* n. sp. (Hypogastruridae) et *Deutonura jeromoltoi* n. sp. (Neanuridae). *Orogastrura tetrophthalma* n. sp. est la première espèce du genre trouvée dans les Alpes du Sud-Ouest. Elle diffère des autres espèces d'*Orogastrura* Deharveng & Gers, 1979 par la grande taille de son organe postantennaire (deux fois plus long que le diamètre d'une cornéule) et la présence de quatre yeux par côté. *Deutonura jeromoltoi* n. sp. est la troisième espèce du genre et le premier *Deutonura* Cassagnau, 1979 endémique du sud-ouest des Alpes. Elle est très similaire à *D. igilica* Dallai, 1983 de Sardaigne, dont elle se différencie par la présence de huit-neuf soies dorso-latérales sur Abd. IV (*vs* sept chez *D. igilica*), et un arrangement différent des soies de l'aire centrale céphalique (B-B:A-B = 1.1 *vs* 0.9 chez *D. igilica*). Le patron complet des pseudopores est décrit pour *Deutonura jeromoltoi* n. sp. et son intérêt potentiel comme caractère diagnostic au niveau supra-générique au sein de l'ordre des Poduromorpha est discuté.

MOTS CLÉS

Hypogastruridae,
Neanuridae,
espèces nouvelles.

INTRODUCTION

Southwestern Alps remain poorly known for their Collembolan fauna compared to other French mountains. No species had been recorded from the Mercantour National Park at the start of the All Taxa Biodiversity Inventory (ATBI) launched by the European EDIT project in 2007 (O. Gargominy pers. comm.). Intensive sampling from 2009 to 2011 by taxonomists of the “Terrestrial Invertebrates” module provided a large number of taxa, from various locations inside and close to the Mercantour National Park. Numerically, Collembolan species represented a large proportion of the collected invertebrates in soil and Malaise samples, with many new records for the southwestern Alps, including several species new to science. Two of these, obtained from soil samples, are described in this paper.

MATERIAL AND METHODS

Most of the specimens studied here have been collected during the standard sampling performed in the course of the “Terrestrial Invertebrates Module” of the ATBI Mercantour project. Deharveng *et al.* (2015) give the detail of the standard sampling performed and the coding of the different samples. The terminology used in the text and table follows Deharveng (1983) and Smolis (2008) for Neanurinae Börner, 1901; and Cassagnau (1974), Babenko *et al.* (1994), Fjellberg (1999) and Thibaud *et al.* (2004) for Hypogastruridae Börner, 1906. Details of standard and non-standard samples are given in “Type material”, and non standard samples are indicated as such.

ABBREVIATIONS

Body parts

Abd.	abdomen;
AIIO	organite of Ant. III;

Ant.	antenna;
Cx	coxa;
Fe	femur;
PAO	post-antennal organ;
Scx2	subcoxa 2;
Ti	tibiotarsus;
Th.	thorax;
Tr	trochanter;
VT	ventral tube.

Groups of chaetae and tubercles (Neanurinae)

Af	antenno-frontal;
Ag	antegenital;
An (=hr)	anal;
CL	clypeal;
De	dorso-external;
Di	dorso-internal;
DL	dorso-lateral;
Fu	furcal;
L	lateral;
Oc	ocular;
So	subocular;
Ve	ventro-external;
Vi	ventro-internal;
VL	ventro-lateral.

Types of chaetae [following the system of Deharveng (1983)]

ML	long macrochaeta;
Mc	short macrochaeta;
me	mesochaeta;
mi	microchaeta;
ms	s-microchaeta;
S	S-chaeta;
or	organite of antenna IV;
mou	blunt chaetae on Ant. IV (“soies mousses” of Ant. IV);
x	labial papilla x.

Institution

MNHN Muséum national d'Histoire naturelle, Paris.



FIG. 1. — *Orogastrura tetrophthalmma* n. sp.: habitus, specimens from sample M090608-DB18. Body size: 650-800 µm.

SYSTEMATICS

Family HYPOGASTRURIDAE Börner, 1906
Genus *Orogastrura* Deharveng & Gers, 1979

REMARK

The new species described here differs from all other species of *Orogastrura* by a lower number of eyes. This, together with the presence of a higher number of eyes in *O. stebaevae* Babenko, 1994 than that previously considered diagnostic for *Orogastrura* requires a revised diagnosis of the genus.

UPDATED DIAGNOSIS OF THE GENUS *OROGASTRURA*. — Hypogastruridae of small size, characterized by a simultaneous regression of eyes, empodial appendage and furcal appendage. Macrochaetae not or only weakly differentiated. No plurichaetosis. Body pigmented. Eyes present, but reduced in number (4-7 per side). Postantennal organ present, with four lobes. Antennae short. No eversible sac between third and fourth antennal segments. Apical vesicle of Ant. IV spherical, large. Internal S-chaetae of Ant. IV not hidden by an integument fold. Mandible and maxilla unmodified. Labrum and labium without modified chaetae. Chaeta a0 present on head. S-microchaetae present on Th. II, absent on Th. III. Chaetae m1 present on Th. II-III. No clavate tenent hairs on tibiotarsi. Unguiculus equal to, or shorter than, one third of inner side of claw and devoid of basal lamella. Ventral tube with 4 + 4 or 5 + 5 chaetae. Tenaculum with three teeth on each ramus. Micro reduced or absent, dens reduced, with three or four chaetae. Two short anal spines.

TYPE SPECIES. — *Orogastrura dilatata* (Cassagnau, 1959).

Orogastrura tetrophthalmma n. sp. (Figs 1-4)

TYPE MATERIAL. — France. Alpes-Maritimes, Saorge, Tête de la Poudrière, 30.VI.2010, soil near the crest, in open forest of *Larix decidua* Mill., Berlese extraction, L. Deharveng, A. Bedos & Sun Xin leg. (sample M100630-DB08; 7.42459E, 44.01388N; altitude 1992 m.), ♀ holotype on slide (collection number MNHN-EA021550). — Same data as holotype (sample M100630-DB03), ♂ paratype on slide (collection number MNHN-EA021551). — France. Alpes-Maritimes, Saint-Dalmas-le-Selvage, Sestrière forest, 08.VI.2009, moss on rocks, in open forest of *Larix decidua* Mill., Berlese extraction, L. Deharveng & A. Bedos leg. (non-standard sample M090608-DB18; 6.823594E; 44.2926706N; altitude 1995 m.), 3 paratypes on slides (1 ♂, collection number MNHN-EA021552; 2 ♂, collection numbers MNHN-EA021553 and 021554); 8 barcoded paratypes (collection numbers MNHN-EA021174 to 021181, but vouchers not retrieved after extraction; 5 of them with CO1 sequences). All types deposited in MNHN.

NAME DERIVATION. — From the Greek roots *tetra* (four) and *ophthalm-* (eyes), in reference to the four eyes per side of the new species.

DISTRIBUTION AND ECOLOGY. — In its two occurrences, *Orogastrura tetrophthalmma* n. sp. was found in moss on rocks and on soil among heath vegetation in open forest of *Larix decidua* Mill. at high elevation in the southwestern Alps.

DESCRIPTION

General

Length: 650-800 µm. Body stocky-elongate, rather flat (Fig. 1). Antennae subcylindrical, equal to head diagonal. Colour: beige-violet to reddish-beige, pale. Eyes black, 4 + 4. Second-

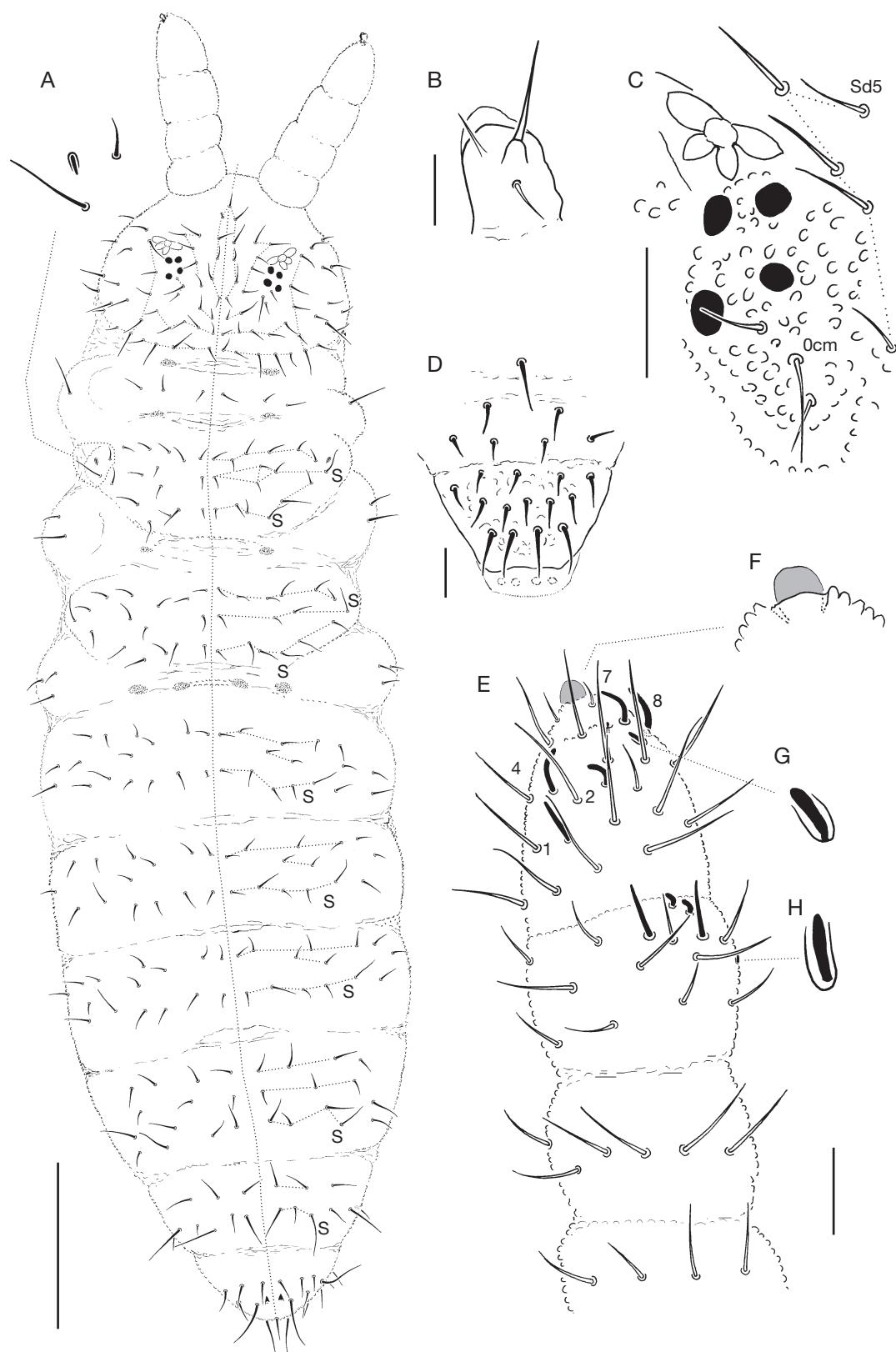


Fig. 2. — *Orogasterura tetrophthalmus* n. sp.: A, dorsal chaetotaxy; B, maxillary outer lobe; C, ocular area; D, labrum; E, right antenna in dorsal view with numbers of Ant. IV S-chaetae; F, apical vesicle of Ant. IV; G, s-microchaeta of Ant. IV; H, s-microchaeta of Ant. III organ. Abbreviations: see material and methods. Scale bars: A, 150 µm; C, E, 20 µm; B, D, 10 µm.

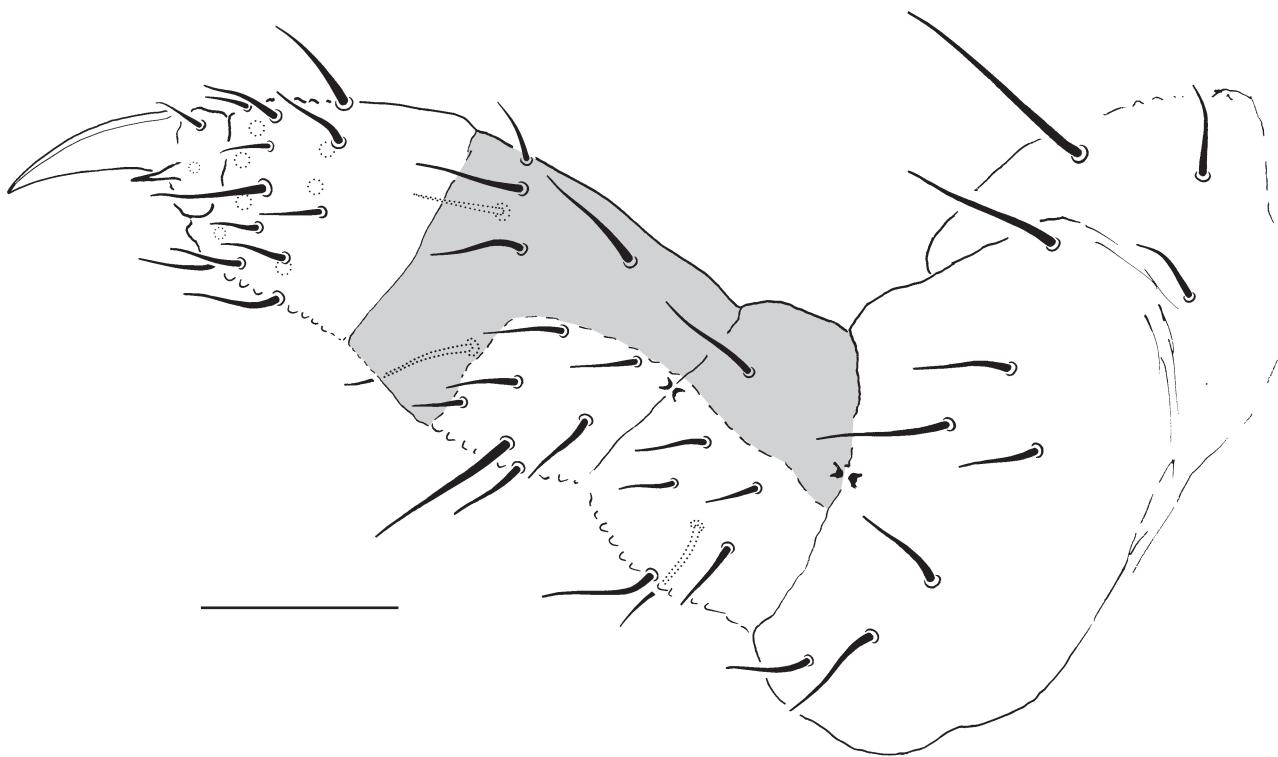


FIG. 3. — *Orogastera tetrophthalma* n. sp. leg II. **Pale grey**, area without secondary granules (primary granules only). Scale bar: 20 μ m.

ary granulation regular, granules the size of ordinary chaetae sockets or smaller. Six secondary granules between chaetae p1 of Abd. V.

Chaetal morphology

Ordinary chaetae of medium size, smooth, acuminate, subequal on tergites, except on head and Abd. V-VI, where the ratio longest/shortest chaetae reaches 2.5-3.0. S-chaetae of four types: 1) long on tergites, slightly thickened, subparallel, slightly longer than, or subequal to, longest ordinary chaetae, similar to blunt chaetae of Ant. IV; 2) medium size, thickened on Ant. III-IV; 3) a pair of short ms, bent and swollen in AIIIO; and 4) short ms, quenelle-like, thick, but thinner than type iii, present at three locations: a lateral one lying in an elongate depression on Th. II, a lateral one in AIIIO and a distal one on Ant. IV.

Ocular area (Fig. 2C).

With 4 + 4 black ocelli. PAO with 4 lobes, 3.5 \times as long as ocellus diameter; each lobe oval-fusiform, anterior lobes larger than posterior ones.

Mouthparts (Fig. 2B, D)

Clypeo-labral formula a0 + 2 + 4/5,5,4, with four anterior chaetae longer. Four more or less distinct subapical papillae dorsally on labrum and a very fine row of microvilliosities on its apical edge. Labium not examined in detail, with rather short chaetae. Maxillary outer lobe with one sublobal hair. Mandible with five (right) or four (left) teeth. Maxilla stocky, with short lamellae, not examined in detail.

Antennae (Fig. 2E-H)

Ant. I and II with 7 and 13 ordinary chaetae, respectively; Ant. III with 19 ordinary chaetae; AIIIO constituted by two small ms flanked by two thickened guard S-chaetae and a small external ms (Fig. 2H). Ant. IV dorsally with 14 blunt chaetae (chaetae "mou"), two ordinary chaetae (i and a distal one), 5 S-chaetae thickened and curved (S1, 2, 4, 7 and 8), of same size as the guard S-chaetae of Ant. III, and one ms lying in elongate socket (Fig. 2G); subapical organite very small; apical exsertile vesicle simple, very large (Fig. 2F); ventrally, various chaetae present but no sensorial rasp.

Dorsal chaetotaxy (Fig. 2A)

Chaeta a0 present on head. Abdominal tergites I, II and III with 3 + 3, 14 + 14 and 14 + 14 chaetae. Chaetae m1 present on Th. II-III and Abd. IV. Chaeta m2 absent on Th. sII-III and Abd. IV. Lateral ms of Th. II relatively large, lying in a depression. S-chaetae position from axis on tergites: 4/4,5,5,5,3. Thoracic sternites without chaetae. Male genital plate not observable; female genital plate with nine circumgenital chaetae and 1 + 1 genital chaetae.

Legs (Fig. 3)

Tibiotarsi I, II, III with 19, 19, 18 chaetae, each with one, pointed, tenent hair, slightly longer than other chaetae. Femora I, II, III with 13, 12, 11 chaetae. Trochantera with 6, 7, 7 chaetae, of which one is thinner. Coxae I, II, III with 3, 7, 8 chaetae. Subcoxae 2 of legs I, II, III with 0,2,2 chaetae. Subcoxae 1 of legs I, II, III with 1, 2, 3 chaetae. Secondary granules not developed

TABLE 1. — Chaetotaxy of *Deutonura jeromoltoi* n. sp. See material and methods for abbreviations.**A. Cephalic chaetotaxy**

Chaetae group	Tubercle	Number of chaetae	Type of chaetae	Name of chaetae
CL	+	4	ML	F
			Mc	G
Af	+	10	ML	B
			Mc	A,C,D,E
Oc	+	3	ML	OCm
			Mc	OCp
Di + De	+	4	me or Mc	OCa
			ML	Di1,De1
DL	+	6	Mc	Di2,De2
			ML	DL1,DL5
L + So	+	10	DL2,DL3,DL4,DL6	
			ML	So1,L1,L4
			Mc	L2,L3
			me	So3 to 6
			mi	L3'

Vi: 6

Ve: 11

Labrum: 4/2.4

Labium: 11, 0x

Ant.I, II: 7, 12

Ant.III: 17+5s (a4 absent)

Ant.IV: 12 mou+or+i+8S

B. Postcephalic chaetotaxy

	Di	De	DL	L	Scx2	Cx	Tr	Fe	Ti
Th.I	1	2	1		0	3	6	13	19
Th.II	3	3+S	3+S+ms	3	2	7	6	12	19
Th.III	3	3+S	3+S	3	2	8	6	11	18
Abd.I	2	3+S	2		3	VT: 4			
Abd.II	2	3+S	2		3	Ve: 5 (Ve1 present)			
Abd.III	2	3+S	2		4	Ve: 5 or 6 ; Fu: 6me, 0mi			
Abd.IV	2	2+S	3		8-9	Ve: 8 ; VL: 4			
Abd.V	3+3		7+S		1	Ag: 3 ; VL: 1			
Abd.VI			7			Ve: 14-15 ; An: 2			

on large parts of trochanter and femur, being absent dorsally, posteriorly and ventro-distally on femur. Claw untoothed; unguiculus short, 3.5 × shorter than inner edge of claw.

Sixth abdominal segment (Fig. 4A, B)

Abd. VI with two very short anal spines, without distinct papillae. Three short mesochaetae hr on each anal valve, those of the upper valve longer. Two strong Mac above upper chaetae hr, bent toward axis and converging proximally. An uneven chaeta just above these Mac, another one just below.

Abdominal appendages

Ventral tube with 4 + 4 chaetae.

Furca as in Fig. 4C. Tenaculum with 3 + 3 teeth. Manubrium with 12-14 + 12-14 posterior chaetae. Dens reduced, with three dorsal chaetae; mucro small, 4-5 × shorter than dens, triangular, separated from dens.

Ratios: GIII:eIII:GI:eI:d:m:eA = 22:6:21:5:29:6:6

REMARKS

The genus *Orogastrura* now includes eight species (Deharveng & Gers 1979; Arbea & Jordana 1990; Babenko *et al.* 1994): five

species from the Pyrenees, one from Siberia, one (*O. parva* (Gisin 1949)) widespread in central Europe, mostly in eastern Alps and Carpathians, but also present in the Abruzzo (Italy), and *O. tetrophthalmata* n. sp., which is the only species restricted to the Alps. The latter is also the only species with four ocelli per side, i.e. the most reduced number in the genus. The ocelli are arranged in an unusual pattern, with none being posterior to chaeta Oca. Apart from the ocular plate characters, this species is very similar to *O. dilatata* and *O. fusca* Gers, 1980 from the Pyrenees in most morphological characters (see key), as well as in its ecology, since all three species live at high altitudes in the upper subalpine or Alpine zone.

Family NEANURIDAE Börner, 1901
Subfamily NEANURINAE Börner, 1901
Genus *Deutonura* Cassagnau, 1979

TYPE SPECIES. — *Achorutes phlegraeus* Caroli, 1912.

Deutonura jeromoltoi n. sp.
(Figs 5-9; Table 1)

TYPE MATERIAL. — France. Alpes-Maritimes, Valdeblore, Col de Salèse, 10.VI.2009, litter in open forest of *Larix decidua* Mill. and *Picea abies* (L.) H. Karst, with understory of meadows and bushes of *Rhododendron ferrugineum* L., Berlese extraction, L. Deharveng & A. Bedos leg. (sample M090610-DB03; 7.23698E; 44.13734N; altitude 2058 m), ♂ holotype (slide M090610-DB03/2, collection number MNHN-EA021555) and 2 paratypes (one ♂, slide M090610-DB03/1, collection number MNHN-EA021556; one juvenile, slide M090610-DB03/3, collection number MNHN-EA021557). — Same data as holotype, soil under M090610-DB03 (sample M090610-DB04), one juvenile paratype on slide (collection number MNHN-EA021558). — Same data as holotype, litter (non standard sample M090610-DB17), 2 juvenile paratypes on slides (collection numbers MNHN-EA021559 and 021560); 2 barcoded paratypes (collection numbers MNHN-EA021244 and 021245, but vouchers not retrieved after extraction; no CO1 sequences obtained). All types deposited in MNHN.

NAME DERIVATION. — The species is named (by contraction) in honour of Jérôme Molto, for his help during the first sampling campaign of 2009.

DISTRIBUTION AND ECOLOGY. — *Deutonura jeromoltoi* n. sp. has been found only in the Boréon valley at about 2000 m, in open coniferous forest. It is replaced by *D. gibbosa* Porco, Bedos & Deharveng, 2010 and undescribed species of *Deutonura* in other valleys of the Mercantour.

DESCRIPTION*General*

Length: 1150 µm (paratype male) to 1800 µm (holotype). Habitus usual for the genus, rather parallel and convex (Fig. 5). Colour: very pale, sparsely mottled with blue on a white background, eyes black, 2 + 2. Dorso-internal tubercle of Abd. V large, prominent, not or barely bilobed. Abd. VI tubercles not large, separated by 10-12 secondary granules. All tubercles well developed on tergites, indicated by reticulations and tertiary granules without papillae, or

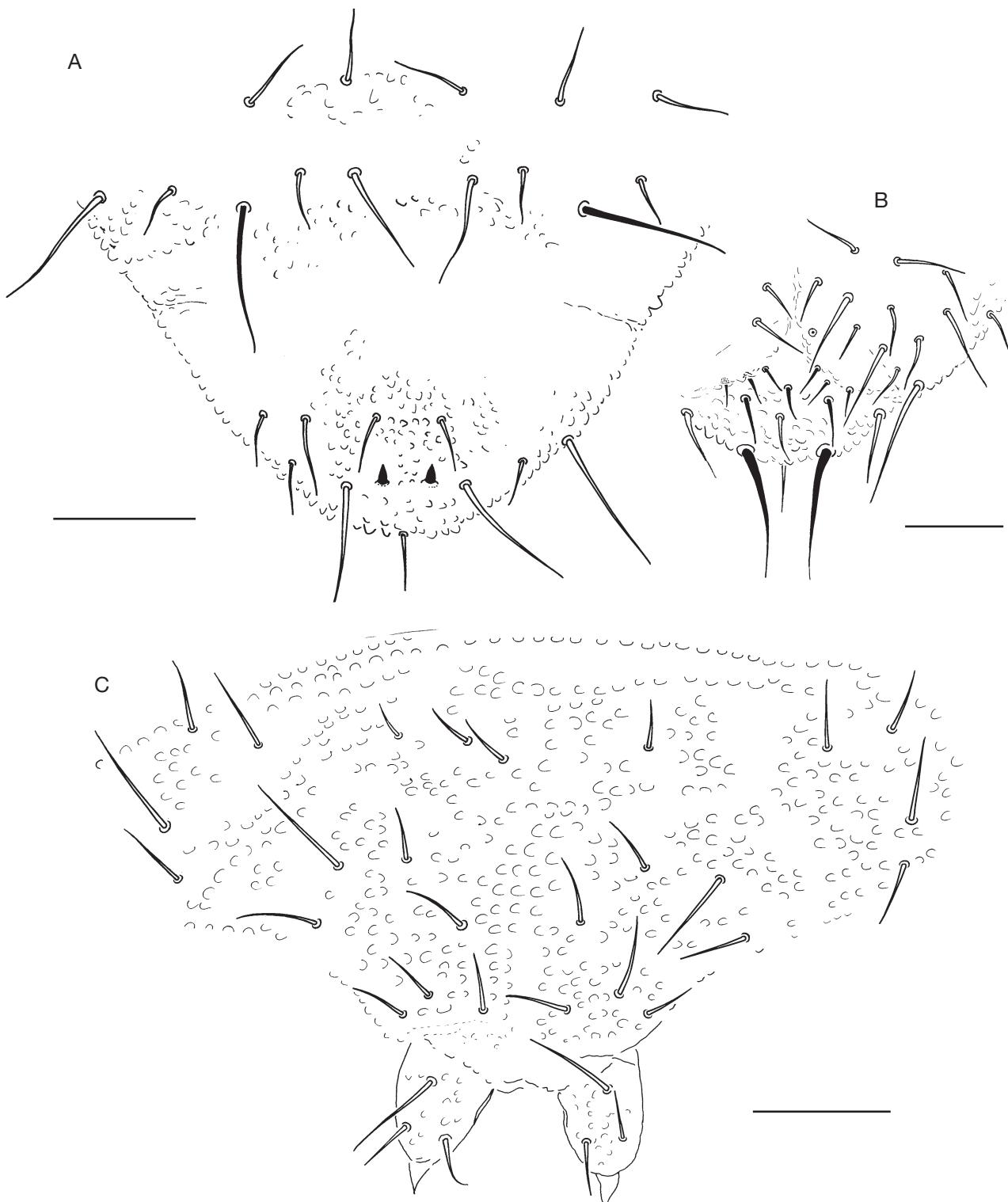


FIG. 4. — *Orogaster tetrophthalmus* n. sp.: A, dorsal side of Abd. V-VI; B, ventral side of Abd. VI; C, posterior side of furca. Scale bars: A, 30 µm; B, 20 µm; C, 25 µm.

with very small ones on hind body where secondary granules are stronger, especially on Abd. V. Elementary tubercles, when well developed, usually with 8-12 secondary granules in adult. All dorsal chaetae integrated in tubercles, except L on Abd. V.

Chaetal morphology

Dorsal ordinary chaetae of four types: long macrochaetae, short macrochaetae, mesochaetae and microchaetae. Long macrochaetae thick to rather thick, finely and sparsely rugose, sheathed, rounded-ogival at apex, except the lat-



FIG. 5. — *Deutonura jeromoltoi* n. sp.: habitus, in dorsal view, of three specimens. Body size 1150 to 1800 μ m.

eralmost ones, which tend to be pointed apically. Short macrochaetae similar to long macrochaetae, apart from length. Mesochaetae similar to ventral chaetae, thin and acuminate, short, smooth, limited to the chaeta Oca (in some specimens only), the most lateral chaeta of Abd. I-II, the two most lateral chaetae of Abd. III, the 2-5 most lateral chaetae of Abd. IV and the lateral chaeta of Abd. V. S-chaetae of tergites long and thin, but much shorter than neighbouring long macrochaetae (2.5 \times shorter on Abd. V). Microchaetae morphologically similar to mesochaetae, but very short, limited to chaeta L3' on head.

Pseudopores

Dorsally arranged 1,1/1,1,1,1 per half tergite from Th. II to Abd. IV, located antero-distally at edge of each De tubercle reticulation. Ventrally 1 at base of each antenna; 1 + 1 on sternites Th. I, II, III; 1 unpaired on Abd. II, 1 + 1 posteriorly on Abd. IV and 1 unpaired anteriorly on Abd. V (Fig. 8). One pseudopore on external side of coxae of legs I, II and III.

Mouthparts (Fig. 6B, C, E)

Reduced. Labrum elongate, rounded-truncate apically, its distal chaetae about twice longer than ante-distal ones

(Fig. 6B); ventro-distal sclerification thin and rounded (Fig. 6C). Labium chaetotaxy: 4 basal, 3 distal and 4 lateral chaetae (Fig. 6E); chaeta A about 1.7-1.8 \times length of C and 1.9-2 \times length of D. Mandible thin and tridentate, its apical tooth subdivided into three thin toothlets; maxilla styliform.

Antennae (Fig. 6F, G)

Typical of the genus. Ant. IV with S-chaetae subequal, moderately thickened, S1 and S2 distinctly thinner than others; apical vesicle trilobed. Dorsal chaeta d4 absent on Ant. III.

Dorsal chaetotaxy and tubercles (Figs 6A; 7A, B; Table 1)

On head, tubercle Af with elementary tubercles DE and EE present, one elementary tubercle between chaetae A and no granular plate between chaetae A and B. Distance B-B about 1.1 \times that of A-B. On Abd. V, tubercles Di V fused into a large, not or barely bilobed, prominent axial tubercle; chaetae Di1, Di2 and Di3 forming an elongated triangle with distance Di1 Di2 about half that of Di1-Di3; Mac Di1 bent and very long, twice as long as Di2; Di3 short macrochaeta, 3-4 \times shorter than Di2 in adult. S-chaetae of thoracic tubercles De antero-internal to De1 and equidistant to De1 and De2.

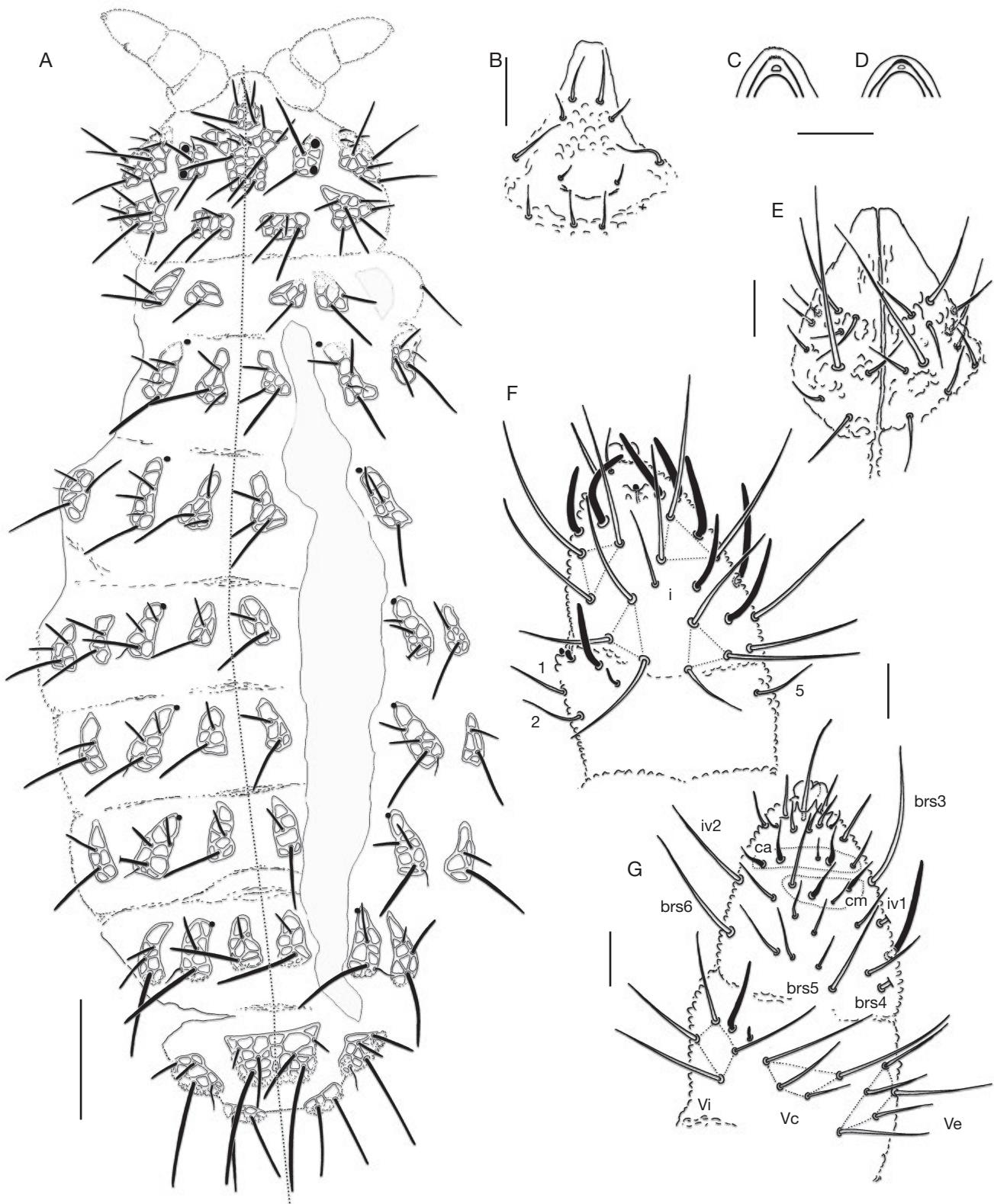


FIG. 6. —A-C, E-G, *Deutonura jeromoltoi* n. sp.; D, *D. gibbosa* Porco, Bedos & Deharveng, 2010: A, dorsal chaetotaxy. **Black spots**, pseudopores; B, labrum chaetotaxy; C, ventro-distal sclerification of labrum in *D. jeromoltoi* n. sp.; D, *idem* in *D. gibbosa*; E, labium; F, left Ant. III-IV in dorsal view; G, left Ant. III-IV in ventral view. Names of antennal chaetae after Smolík, 2008. Scale bars: A, 100 µm; B-E, 20 µm.

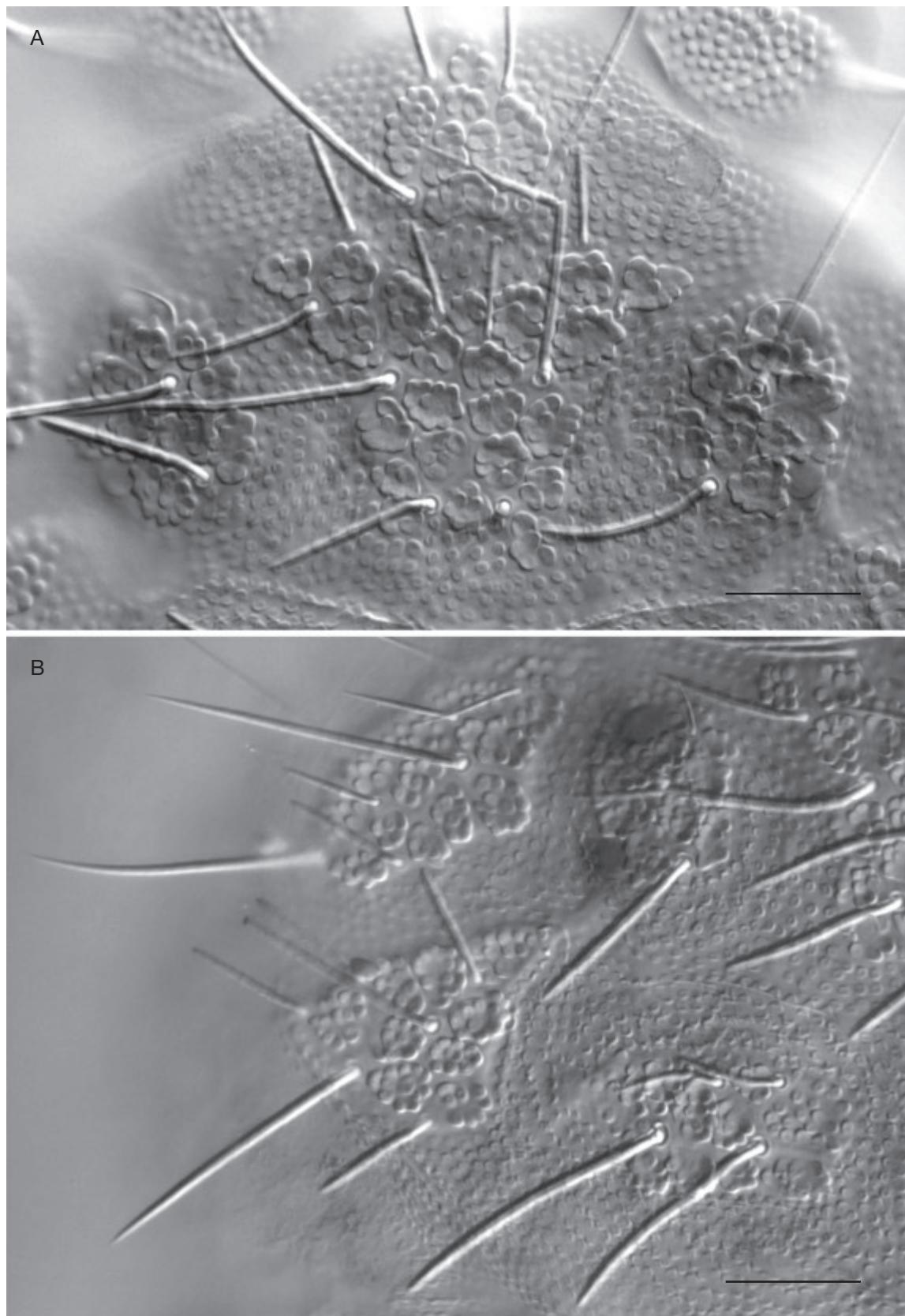


FIG. 7. — *Deutonura jeromoltoi* n. sp.: A, central area of head; B, genal and posterior areas of head. Scale bars: A, B, 50 µm.

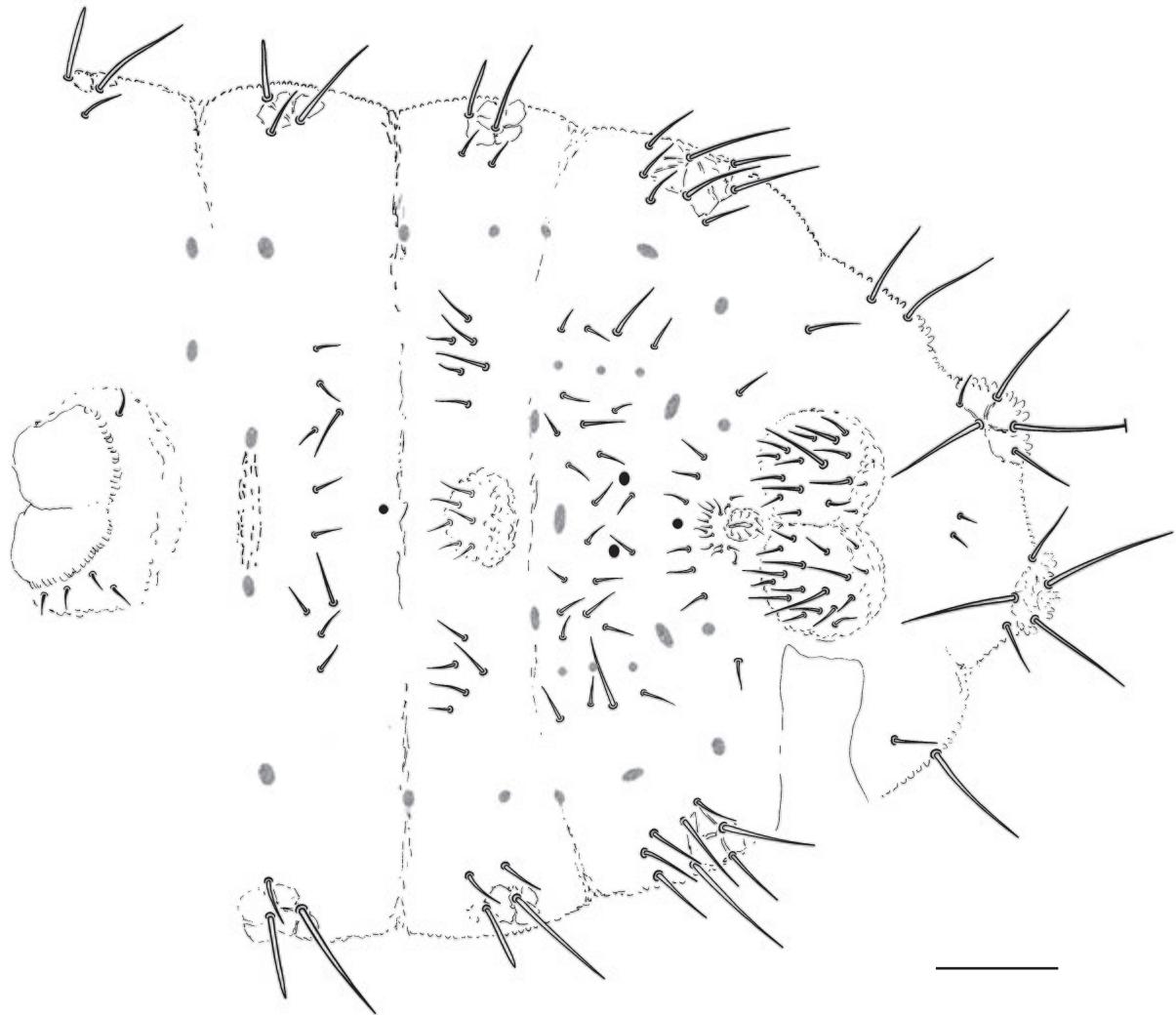


FIG. 8. — *Deutonura jeromoltoi* n. sp.: abdominal sternite chaetotaxy. **Grey areas**, muscular insertions; **Black spots**, pseudopores. Scale bar: 100 µm.

Ventral chaetotaxy (Fig. 8; Table 1)

Male without modified chaetae; male genital plate with 4 + 4 microchaetae Ge and 18 chaetae Cg.

Legs (Table 1)

Tibiotarsi with chaeta M present; B4 and B5 moderately long, not or only slightly overpassing apex of tibiotarsi. Claw basally granulated, without inner tooth.

REMARKS

Deutonura jeromoltoi n. sp. is morphologically similar to *D. igilica* Dallai, 1983, a species endemic to the island of Giglio, near the coast of Tuscany (Dallai 1983). It differs from that species by a higher number of lateral chaetae on Abd. IV (8-9 vs 7), a less elongate frontal tubercle (B-B:A-B = 1.1, vs 0.9; Fig. 9A, B) and a weaker development of Abd. VI tubercles. The uneven dorso-internal tubercle of Abd. V in a non-type specimen in Dallai's collection, collected from Valle del Corvo (27.X.1972) and labelled *D. igilica*, is rather different to that of *D. jeromoltoi*

n. sp., being less prominent and with only 2 + 2 chaetae (instead of 3 + 3) (Fig. 9C, D); however, as described by Dallai, the types have 3 + 3 chaetae. *D. jeromoltoi* n. sp. is also closely related to *D. gibbosa*, recently described from the Alps (where it is widespread), and also present in the Mercantour park. The two species have a very similar arrangement of tubercles and chaetotaxy, and the same morphology of mouthparts, including thin ventro-distal sclerifications (Fig. 6C, D). They differ by the number of chaetae on the tubercle De of Th. II (3 S vs 2 S in *D. gibbosa*), and tubercle Di of Abd. V, which in *D. jeromoltoi* n. sp. is clearly shorter, less prominent and not bilobed.

The new species is endemic to the southwestern Alps, whereas *D. gibbosa* has a much wider distribution, extending across the whole Alpine range and into the Jura.

PSEUDOPORE PATTERNS IN *PODUROMORPHA* BÖRNER, 1913
Among the morphological characters described for *Deutonura jeromoltoi* n. sp., the complete pattern of pseudopore

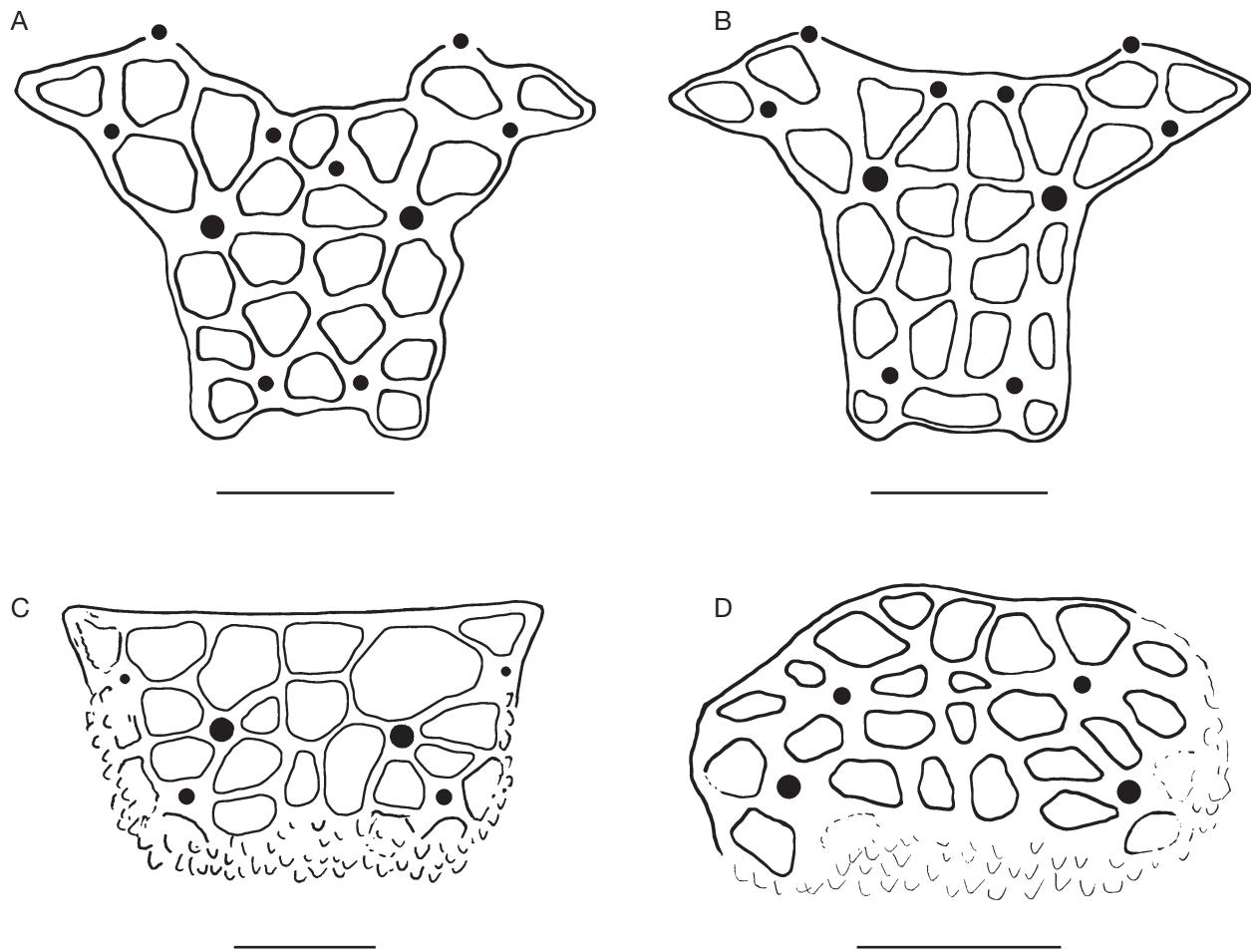


FIG. 9. — **A, C**, *Deutonura jeromoltoi* n. sp.; **B, D**, *D. igilica* Dallai, 1983; **A, B**, reticulations of antero-frontal tubercle; **C, D** reticulations of dorso-internal tubercle of Abd. V. Scale bars: 50 μ m.

distribution was established. It matches, in all details, the pattern previously described in *Neanura muscorum* (Templeton, 1935) and subsequently observed in other Neanurinae (*Bilobella aurantiaca* Caroli, 1910 and *Thaumanura ruffoi* Dallai, 1969) by Deharveng (1983). Pseudopores are usually overlooked in taxonomic descriptions of Neanurinae, since they are often similar to muscular insertion areas, being constituted by rounded, micro-perforated areas devoid of secondary granules, of a size similar to that of muscular insertions (Deharveng 1983: fig. 3D), with which they can be easily confused. They differ in their slightly swollen and more regularly perforated surface. We did not detect pseudopores in *Orogastrura tetrophthalma* n. sp. and they have never been mentioned in Hypogastruridae, as far as we know. Conversely, they have been found in Pseudachorutinae (Neanuridae), Odontellidae, Tullbergiidae and Onychiuridae (Deharveng 1983:15; pl. 3d-e). Their pattern is sometimes given in descriptions of Onychiuridae, in which it differs ventrally from that of Neanuridae (Deharveng 1979; Weiner & Fjellberg 1994; Sun et al. 2010, 2011; Sun & Wu 2012). However, small

differences exist between the published descriptions of onychiurid species, pointing to the need to re-examine them in comparison to the well-documented pseudopore pattern of Neanurinae.

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KEY TO SPECIES OF *OROGASTRURA* DEHARVENG & GERS, 1979

1. 7+7 ocelli. Mucro present. Dens with four chaetae. Chaetae m1 present on Abd. V
..... *O. stebaevae* Babenko, 1994. Distribution: West Siberia (Russia).
— 6+6 ocelli or less..... 2
2. 6+6 ocelli. Mucro present. Dens with four chaetae. Chaetae m1 absent on Abd. V. Ventral tube with 5 + 5 chaetae
..... *O. parva* (Gisin, 1949). Syn. *Hypogastrura parvula* Haybach, 1972 after Skarżyński (2011). Distribution (after Thibaud 2004): Europe: central and eastern Alps (1800-3100 m.), Sudetes (1300 m), Carpathians (1700-2000 m), Abruzzes (1100-1900 m); Japan: Honshu (2700 m, dubious record).
— 5+5 ocelli or less..... 3
3. 5+5 ocelli 4
— 4+4 ocelli. Chaetae m1 absent on Abd. V
..... *O. tetrophthalmalma* n. sp. Distribution: France: southwestern Alps (2000 m).
4. Mucro absent. Dens with three chaetae. Ventral tube with 4+4 chaetae. S-chaeta of Abd. I to Abd. IV in position 4 from the axis in the posterior row
..... *O. emucronata* Deharveng & Gers, 1979. Distribution: France: eastern Pyrenees (2400 m).
— Mucro present 5
5. Ventral tube with 5+5 chaetae. Mucro bidentate. Dens with 4 chaetae. S-chaeta of Abd. I to Abd. IV in position 4 from the axis in the posterior row... *O. pallida* (Cassagnau, 1954). Distribution: France: central, eastern and western Pyrenees (1575-2500 m).
— Ventral tube with 4+4 chaetae. Mucro triangular 6
6. Dens with 4 chaetae. S-chaeta of Abd. I to Abd. IV in position 5 from the axis in the posterior row
..... *O. octoseta* Arbea & Jordana, 1990. Distribution: Spain: Navarra and Huesca (1270-1870 m).
— Dens with 3 chaetae. S-chaeta of Abd. I to Abd. IV in position 4 from the axis in the posterior row 7
7. Ratio mucrodens:claw III = 1.0-1.3
..... *O. dilatata* (Cassagnau, 1959). Distribution: France: central and western Pyrenees (2100-2500 m).
— Ratio mucrodens:claw III = 1.8-2.0
..... *O. fusca* Gers, 1980. Distribution: France: eastern Pyrenees (1800-1900 m).

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